AGU FALL MEETING
San Francisco | 14–18 December 2015

H33M-04: Energy Budget Changes Impact Arid Mountain Hydrology More Than Rain-Snow Transitions

ABSTRACT

Wednesday, 16 December 2015
14:25 - 14:40
Moscone West - 3011

Temperature increases due to climate change will alter two main drivers of hydrology, energy and moisture, by reducing the fraction of precipitation falling as snow, as well as impacting the land surface energy budget. Recent hydrological work has studied the impacts of these two drivers using statistical analysis of basins with different average precipitation and climate as proxies for moisture and energy changes, however, very few studies have used modeling to explicitly separate energy budget changes from snow to rain transitions. Integrated models provide an opportunity to isolate these effects of climate change from natural interannual variability, the latter of which are difficult to tease out in field and statistical studies. Given that much of the world depends on mountain snowpack for their water supply, understanding hydrologic sensitivity to variability in phase and amount of precipitation, temperature and runoff in complex terrain is imperative.

This study uses an integrated hydrologic model, Parflow, fully coupled to the Common Land Model, to investigate a hypothetical, vegetated mountain hillslope response to energy budget and precipitation phase changes due to warming. In our simulations, year round warming scenarios decreased mean streamflow by approximately 20%, contrary to shifts from snow to rain which in some scenarios exhibited a small increase in streamflow, indicating that energy budget is the main driver of total mean streamflow. Seasonal warming impacted the volume of peak runoff, with winter and transitional (fall&spring) warming

increasing peak runoff by more than 15%, suggesting that interannual variation in temperature may aid in flood risk calculations. This modeling framework can be applied in other regions to provide context and points of comparison for existing observational and statistical studies of climate change impacts on hydrology.

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